

Kentucky Public Schools Energy Management Report

High Performance Sustainable Schools Workshop

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Kentucky School Boards Association

Thanks to our Partners

- Energy in Education Collaborative
 - DEDI
 - Kentucky NEED
 - Green and Healthy Schools
- School Energy Managers

Statutory Requirements

- KRS160.325 - School Energy Management
 - Develop & Implement Energy Management Plan
 - Annual Report to Board and Legislative Research Commission
- KRS157.455 - Highly Efficient Buildings
 - Create Healthy Environment while Saving Energy
 - Use Life-Cycle Analysis in Proposal Evaluation
 - Consider Net-Zero Construction

Board Policy 05.23

- District Level Committee
 - Develop & Implement Energy Management Plan
 - Track & Monitor Progress Managing and Reducing Costs
- Superintendent Annually Reports to DEDI & LRC
- Year-end Report to Board

Where Had Schools Been?

- \$140 Million Annually on Utilities
- No Comprehensive Energy Plan
- Reliance on Mechanical Systems
- 12 ENERGY STAR Listed Schools

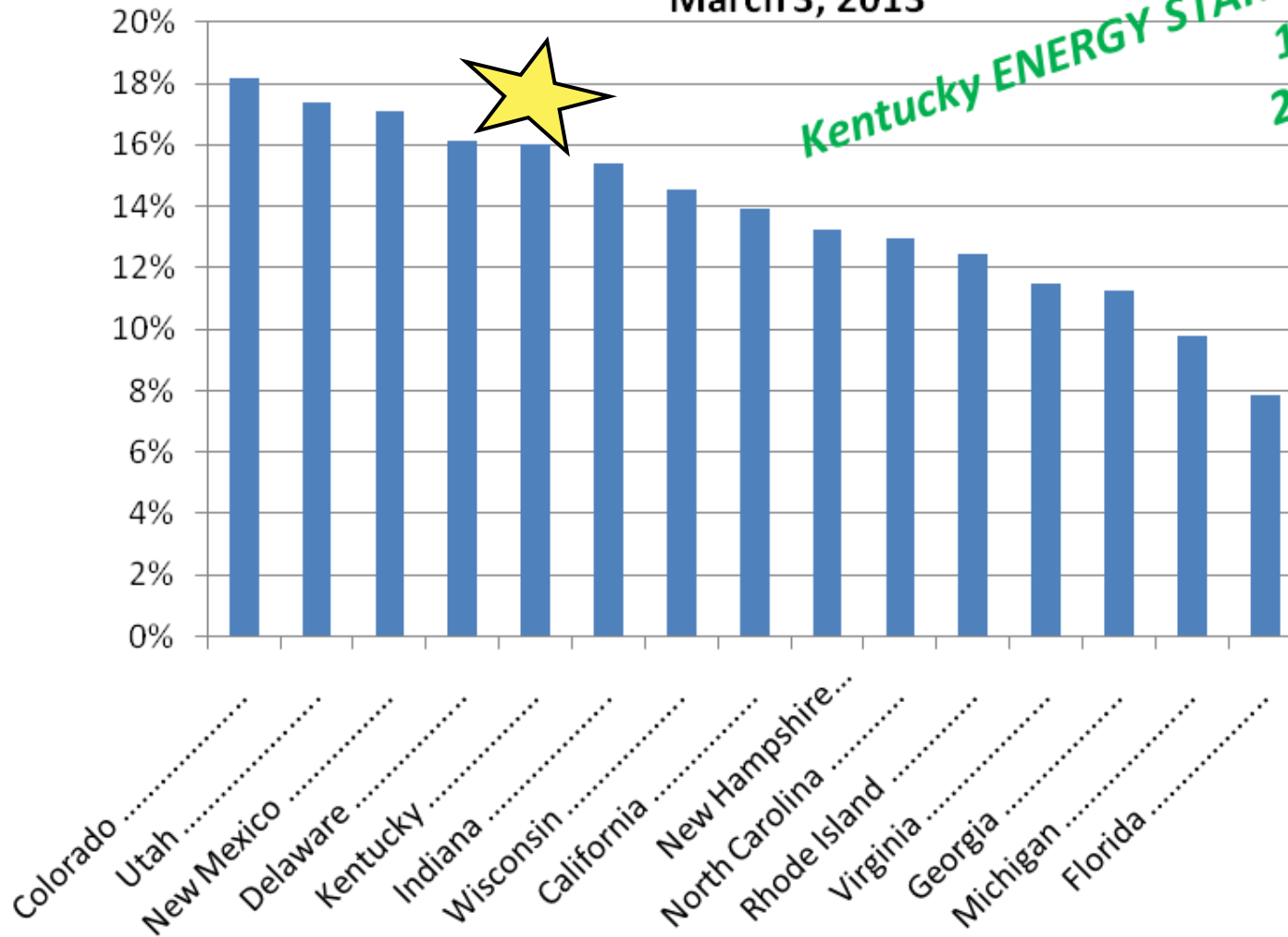
History

- SEMP Originated in July 2010
 - 35 Energy Managers - 130 districts
 - 14 Existing Energy Managers
 - Funded Initially with \$5M ARRA Funds
 - Matching Funds to School Districts for Energy Managers

% ENERGY STAR Certified Schools

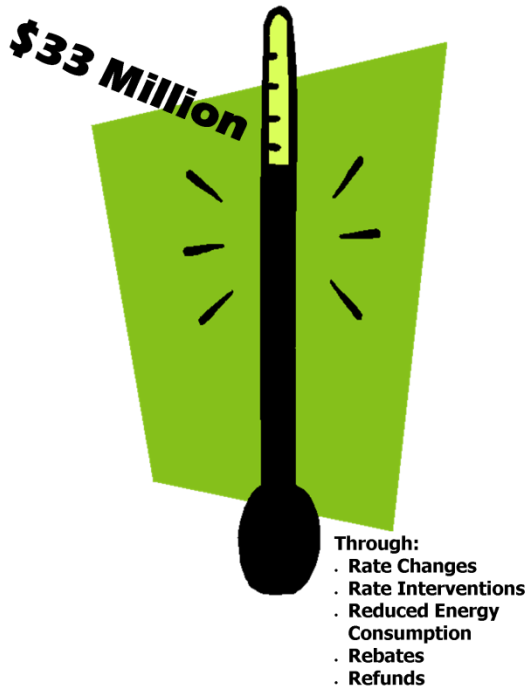
March 3, 2013

Kentucky ENERGY STAR SCHOOLS
12 in 2008
247 in 2014



Cumulative Monetary Savings

SAVINGS TO DATE



Cumulative Savings To Date		
Actions Taken	FY2012-13	Cumulative FY2010-13
Consumption	\$ 12,900,000	\$ 25,500,000
Rate Correction	\$ 1,480,000	\$ 4,230,000
Utility Case Intervention	\$ 350,000	\$ 1,680,000
Rebates & Refunds		\$ 1,420,000
Total	\$ 14,730,000	\$ 32,830,000

FY 2009-10 Survey

- 1st Statewide EMR Survey conducted using FY2009-10 data
 - District Information
 - Energy Fuels and Costs
 - Prior to Most Energy Managers
- 92% Participation Rate

FY 2012-13 Survey

- 164/174 Districts Reporting (94%)
- 42/164 (26%) Required One-On-One Contact
 - Data Verification/Correction
 - Based on Rate Analysis
 - Based on Trend Analysis
 - Based on YTY Large Scale Change
- An Energy Utilization Index, EUI, energy use (kBtu) per square foot calculated at a statewide level and for each reporting district.
 - Base Year 2009-10 = 64.2 kBtu/sf/yr
 - FY2012-13 = 58.6 kBtu/sf/yr.

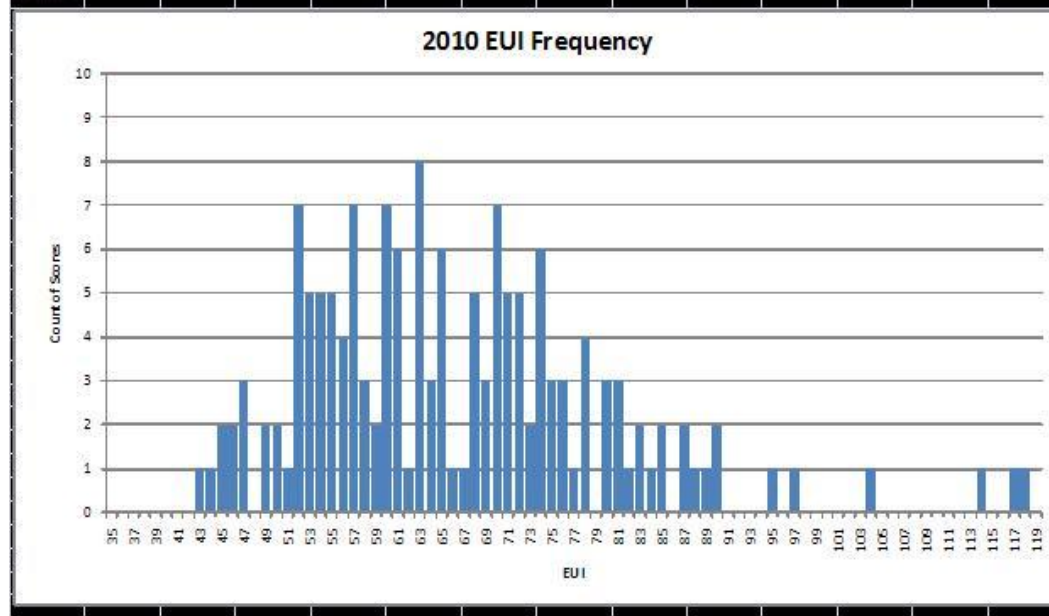
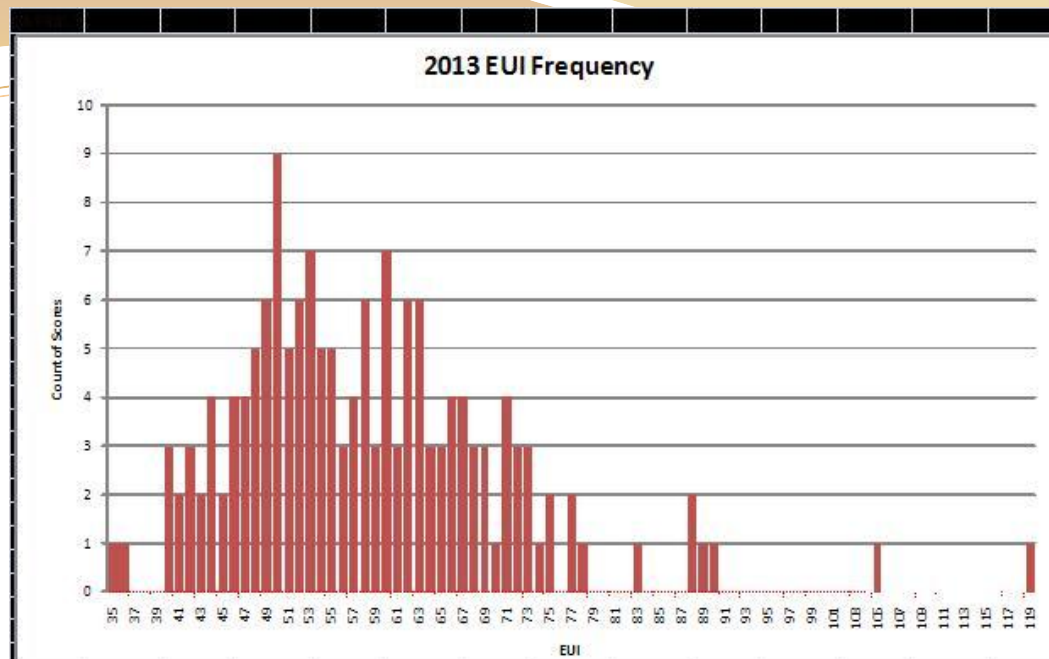
Base and Current Year Comparison

TABLE 1

Comparisons	FY 2012/13	FY2009/10 (base)
Energy Usage & Costs		
Total Statewide Energy Cost,\$	\$ 129,691,522	\$ 129,493,828
Total Statewide Energy Usage, MMBTU	6,107,416	6,574,084
Square Footage	103,718,503	100,061,410
Average Energy Use Intensity (EUI), kbtu/sq ft	58.37	63.85
EUI Standard Deviation	12.26	14.3
Operating Cost, \$/sq ft	\$ 1.25	\$ 1.29
Electricity Usage Statewide, kwh	1,238,222,141	1,304,395,702
Electricity Cost Statewide, \$	\$ 114,669,718	\$ 110,709,838
Electricity Rate Statewide Average, \$/kwh	\$ 0.093	\$ 0.085
Electricity Rate Statewide Low, \$/kwh	\$ 0.04	\$ 0.03
Electricity Rate Statewide High, \$/kwh	\$ 0.14	\$ 0.12
Natural Gas Usage Statewide, ccf	17,348,770	19,386,792
Natural Gas Cost Statewide, \$	\$ 13,437,764	\$ 17,048,721
Natural Gas Rate Statewide Average, \$/ccf	\$ 0.77	\$ 0.88
Natural Gas Rate Statewide Low, \$/ccf	\$ 0.59	\$ 0.68
Natural Gas Rate Statewide High, \$/ccf	\$ 2.21	\$ 2.12
Propane Usage Statewide, gal	584,629	569,286
Propane Cost Statewide, \$	\$ 950,914	\$ 880,092
Propane Rate Statewide Average, \$/gal	\$ 1.63	\$ 1.55
Propane Rate Statewide Low, \$/gal	\$ 1.17	\$ 0.98
Propane Rate Statewide High, \$/gal	\$ 2.90	\$ 3.64
Fuel Oil Usage Statewide, gal	154,006	288,948
Fuel Oil Cost Statewide, \$	\$ 514,351	\$ 670,407
Fuel Oil Rate Statewide Average, \$/gal	\$ 3.34	\$ 2.32
Fuel Oil Rate Statewide Low, \$/gal	\$ 2.87	\$ 2.05
Fuel Oil Rate Statewide High, \$/gal	\$ 3.69	\$ 2.48
Coal Usage Statewide, tons	896	1,448
Coal Cost Statewide, \$	\$ 118,775	\$ 184,769
Coal Rate Statewide Average, \$/ton	\$ 142.11	\$ 138.80
Coal Rate Statewide Low, \$/ton	\$ 129.55	\$ 130.56
Coal Rate Statewide High, \$/ton	\$ 159.00	\$ 145.01

What is an Average School District?

The Average School District in Kentucky				
			Entire State	Less Fayette & Jefferson Counties
# of Elementary Schools			4.3	3.6
# of Middle and High Schools			2.7	2.3
		Total	7.0	5.9
Energy Consumption, MMBTU			37,700	29,481
Energy Spend, \$			\$ 800,565	\$ 642,022
Conditioned Square Footage			640,238	515,757

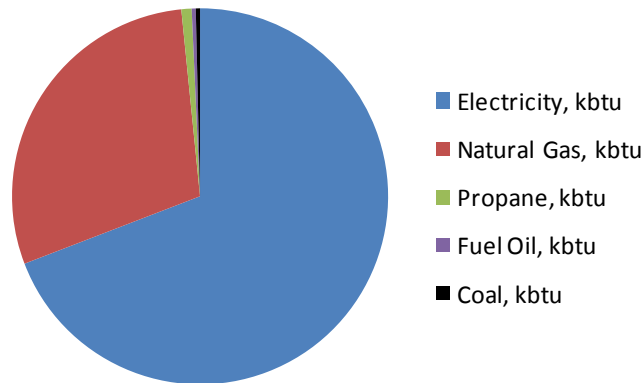


Energy Use Profile

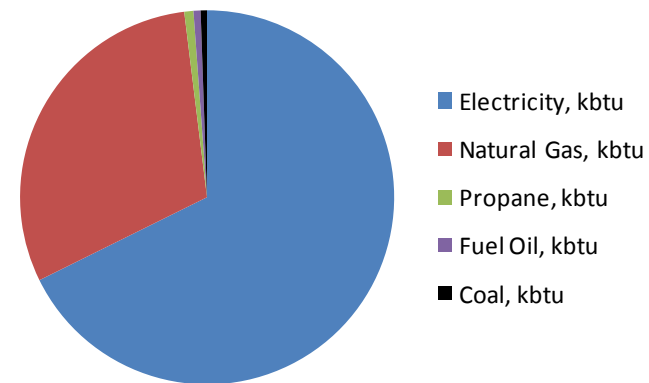
TABLE 2

Site Energy Makeup Profile	FY2012/13	%	FY2009/10	%
Electricity, kbtu	4,224,813,945	69.2%	4,450,598,135	67.7%
Natural Gas, kbtu	1,785,188,438	29.2%	1,994,900,876	30.3%
Propane, kbtu	53,579,881	0.9%	52,173,650	0.8%
Fuel Oil, kbtu	21,359,169	0.3%	40,074,343	0.6%
Coal, kbtu	22,474,368	0.4%	36,336,593	0.6%
Total, kbtu	6,107,415,801		6,574,083,596	

**FY2012/13 Site Energy Use
Profile Statewide**



**FY2009/10 Site Energy Use
Profile Statewide**



District Ranking

Rank	District	2010 EUI	2013 EUI	Rank	District	2010 EUI	2013 EUI	Rank	District	2010 EUI	2013 EUI	Rank	District	2010 EUI	2013 EUI
1	Butler	42.8	35.2	42	Carlisle	46.9	49.9	83	Boyle	65.9	57.1	124	Letcher	62.9	64.9
2	Corbin	51.6	36.3	43	Allen	57.1	50.0	84	RaceLand- Worthington	67.0	57.3	125	Pike County	51.6	65.2
3	Walton-Verona	44.6	39.7	44	Magoffin	60.7	50.1	85	Rowan	72.3	57.3	126	Johnson	78.2	65.5
4	Robertson	114.5	40.2	45	Barren	49.8	50.1	86	Pineville	54.7	57.4	127	Caverna	84.2	65.9
5	Casey	49.5	40.3	46	Trigg	60.2	50.2	87	Woodford	63.5	57.5	128	Ballard	80.1	66.3
6	Anderson	52.3	40.8	47	Russellville	52.5	50.3	88	Madison	56.4	57.9	129	Washington	83.5	66.4
7	Owen	62.5	41.3	48	Southgate	47.2	50.6	89	Cloverport	72.7	58.0	130	Marshall	70.9	66.5
8	Scott	53.3	42.1	49	Glasgow	62.6	50.7	90	Clark	74.7	58.3	131	Hickman	61.9	67.0
9	Murray	47.2	42.2	50	Estill	53.4	51.1	91	Monroe	48.6	58.3	132	Laurel	64.0	67.0
10	Oldham	45.7	42.3	51	Paintsville	53.3	51.1	92	Webster	75.5	58.6	133	Carroll	82.9	67.2
11	Monticello	58.0	43.0	52	Russell	70.3	51.1	93	Harrison		59.1	134	Union	69.1	67.2
12	Hardin	54.3	43.7	53	Augusta	55.6	51.5	94	Clay	65.4	59.2	135	Boone	74.0	67.3
13	Bullitt	53.7	43.7	54	Frankfort	80.7	51.5	95	Elliott	48.8	59.6	136	Montgomery	70.2	67.7
14	Warren	50.7	44.0	55	Garrard	51.5	51.8	96	Perry	67.0	59.9	137	Berea	75.7	67.8
15	Burgin	60.5	44.5	56	Lawrence	68.6	52.0	97	Menifee	90.4	60.0	138	Campbell	70.2	67.9
16	Grayson	60.0	44.6	57	Paris	59.6	52.3	98	Jenkins	67.6	60.1	139	Bell	104.3	68.5
17	Nicholas	44.5	45.0	58	Pulaski	52.4	52.4	99	Owensboro	70.1	60.4	140	Danville	64.6	68.8
18	Taylor	64.7	45.5	59	Spencer	63.1	52.5	100	Henry	67.7	60.4	141	Muhlenberg	68.5	68.9
19	Wolfe	36.3	45.6	60	Marion	60.3	52.5	101	Mercer	78.3	60.5	142	McCracken	62.7	69.4
20	Jessamine	50.3	45.9	61	Boyd	81.2	52.5	102	West Point	DNR	60.5	143	Morgan	116.8	69.9
21	Gallatin	60.0	46.1	62	Campbellsville	76.4	52.6	103	Hazard	87.2	60.6	144	Pikeville	81.9	70.6
22	Trimble	52.3	46.2	63	Caldwell	60.7	52.8	104	Breckinridge	71.2	60.8	145	Simpson	73.6	71.4
23	Dawson Springs	61.0	46.7	64	Metcalfe	60.9	52.8	105	Bardstown	62.8	60.9	146	Anchorage	73.8	71.5
24	Clinton	53.5	46.8	65	Nelson	53.0	53.0	106	Fulton Co.	63.7	61.1	147	Hopkins	71.7	71.8
25	Fleming	69.8	47.0	66	Bracken	55.0	53.1	107	LaRue	55.1	61.7	148	Bellevue	68.4	72.0
26	Wayne	64.2	47.1	67	Edmonson	58.7	53.3	108	Bourbon	65.0	61.8	149	Henderson	74.1	72.2
27	Erlanger	56.9	47.1	68	Russell	80.5	53.4	109	Bowling Green	73.6	61.8	150	Covington Ind.	80.5	72.5
28	Science Hill	56.5	48.1	69	Cumberland	71.1	53.5	110	Franklin	87.3	62.3	151	Beechwood	62.6	73.2
29	Jackson Co	57.4	48.3	70	Whitley	57.7	53.6	111	Grant	70.7	62.3	152	Hart	73.5	73.2
30	McLean	45.9	48.4	71	Lee	78.3	53.8	112	Mason	57.9	62.5	153	Fayette	78.2	73.9
31	Crittenden	57.1	48.5	72	Kenton	64.9	54.2	113	Ashland	75.1	62.6	154	Barbourville	76.8	74.7
32	Williamstown	63.3	48.6	73	Livingston	56.9	54.2	114	Jefferson	68.2	62.6	155	Bath	87.8	74.9
33	Lyon	53.7	48.6	74	Williamsburg	54.9	54.5	115	Dayton	67.4	62.8	156	Middlesboro	60.9	76.7
34	Meade	48.7	48.9	75	Silver Grove	69.2	54.6	116	Mayfield	43.6	62.9	157	Somerset	89.8	77.1
35	Martin	64.0	49.1	76	Lincoln	70.7	55.0	117	Eminence	85.3	63.2	158	Ft. Thomas	72.2	77.7
36	Floyd	52.0	49.1	77	Carter	59.3	55.2	118	Lewis	70.4	63.3	159	Breathitt	64.0	79.6
37	Pendleton	55.9	49.2	78	Logan	54.5	55.2	119	Knott	DNR	64.0	160	Powell	97.0	82.8
38	Shelby	71.6	49.2	79	Christian	70.1	55.4	120	Graves	60.2	64.2	161	Green	88.2	87.6
39	Hancock	57.8	49.5	80	Knox	64.8	55.8	121	Elizabethtown	72.9	64.3	162	McCreary	94.8	89.0
40	Daviess	53.9	49.5	81	Calloway	56.2	56.4	122	Adair	71.1	64.7	163	East Bernstadt	88.7	89.7
41	Newport	76.1	49.9	82	Rockcastle	59.9	56.7	123	Ludlow	107.9	64.9	164	Jackson Ind	117.6	118.6

Overall Observations and Conclusions

★ High Correlation between a trained energy manager and a lower EUI score. 6% More Savings in districts with a trained energy manager.

- Total energy use has decreased 7.2%.
 - better, new, and renovated spaces using efficient energy design as envisioned by KRS157.455
 - better building energy management as envisioned by KRS160.325.
- Overall cost of energy for these reporting districts has remained relatively flat only increasing 0.1%.
 - selection of advantageous rate structures
 - aggregated natural gas purchasing
 - all the while rising electric costs being partially offset by falling natural gas costs
- Statewide EUI for the reporting districts has fallen from 64.2 kbtu/sf/yr in the base year (2009/10) to 58.6 kbtu/sf/yr in the most recent completed fiscal year of 2012/13.

Overall Observations and Conclusions (continued)

- Figures 1 and 2 show the distribution of district EUI values compared between the base fiscal year 2009/10 and the most recent fiscal year 2012/13. Comparisons of these figures show a lowering of the overall average and a tightening of the distribution.
- Conditioned square footage has increased 3.6% and indications are that the new spaces are highly efficient.
- Electricity dominates as the fuel source (2/3), natural gas (1/3)

Natural Gas Aggregate Pricing



After Action Review

- What did you expect?
- What did you get?
- What went well and why?
- What could be improved upon?

After Action Review Process Improvements

- Improving Data Quality
 - Training for non-full time energy managers
 - District Specific Handouts
 - Clarification on square footage changes
- Data Verification
 - Cross checks with MUNIS dollars
 - Requires data conversion to energy units
 - We will use conditional and automatic alerts

District Specific Handout

Electric EUI kbtu/sq ft				Square Footage							
FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013				
40.51	39.72	37.03	35.90	1,700,000	1,864,460	1,906,093	1,906,093				
Total EUI kbtu/sq ft				TOTAL COSTS							
FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013				
53.71	48.76	43.59	43.71	\$2,024,642	\$2,209,603	\$2,242,513	\$2,257,911				
AVOIDED CONSUMPTION COSTS											
FY2010	FY2011	FY2012	FY2013	CUMULATIVE							
Base year	\$110,393	\$321,854	\$359,907	\$792,154							
CONSUMPTION				COSTS				Rate			
KWH				ELECTRICITY							
FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013
20,184,136	21,702,211	20,684,107	20,056,854	\$1,840,911	\$2,052,474	\$2,116,981	\$2,125,721	\$ 0.091	\$ 0.095	\$ 0.102	\$ 0.106
CCF				NATURAL GAS							
FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013
223,712	168,058	124,929	148,647	\$182,234	\$155,724	\$124,768	\$131,426	\$ 0.815	\$ 0.927	\$ 0.999	\$ 0.884
GALLONS				PROPANE							
FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013
738	726	264	264	\$1,497	\$1,405	\$764	\$764	\$ 2.03	\$ 1.94	\$ 2.89	\$ 2.89
TONS				COAL							
FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013
0	0	0	0	\$0	\$0	\$0	\$0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
GALLONS				FUEL OIL							
FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013	FY2010	FY2011	FY2012	FY2013
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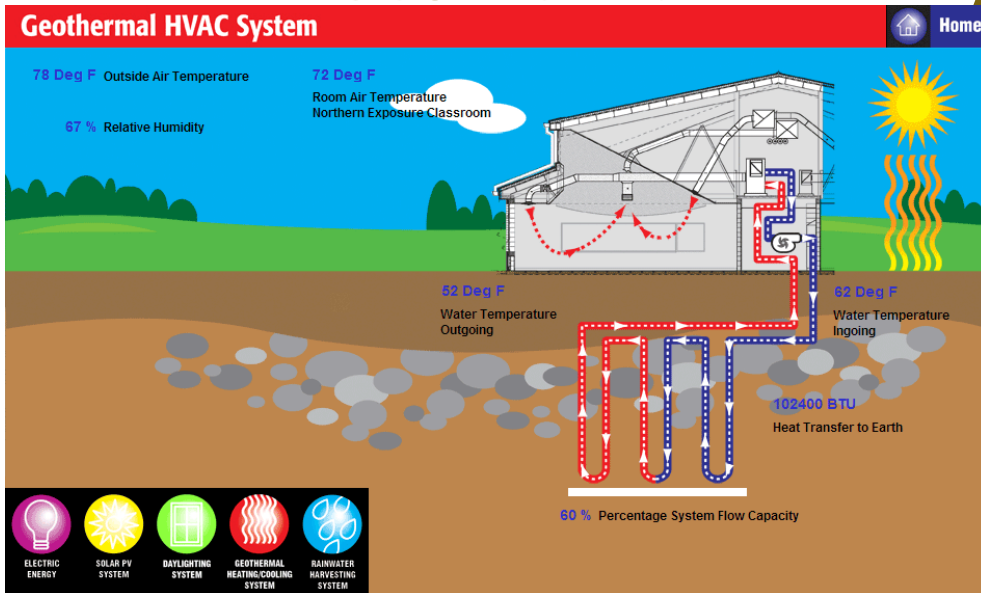
Taking Advantage of New Construction and Renovation to Improve your District EUI

A Case Study

New Construction

Maurice Bowling Middle

- **Exterior Shell**
- **T5 Lighting with Motion Sensors**
- **Employs “dark campus” outdoor lighting**
- **Web-based Building Automation Control**
- **Geothermal HVAC System**



Renovation

Old MBMS Converted to Elementary

➤ Kept

- **Reflective White Roof**
- **HVAC system**
- **Envelope**

➤ Added

- **1040 Sq. FT - Foyer & Admin Area**
- **Building Automation Control w/ lighting integrated**
- **New Gym Lighting (replace Metal Halide)**

➤ **Replaced T12 Lighting as Maintenance Project prior to the start of renovation.**

Construction & Renovation Results

	Square Footage	EUI, kbtu/sf	Cost/sf	Annual Operating cost
Original Building	58,500	54.1	\$ 1.40	\$ 81,910
Renovated Building	59,540	29.1	\$ 1.01	\$ 60,135
New Construction	106,874	22.6	\$ 0.72	\$ 76,949

District Wide EUI and ENERGY STAR Rating

- District-wide EUI prior to construction and renovation was 62.5
- District-wide EUI after construction and renovation is 41.3
- New MBMS has an ENERGY STAR rating of 98
- Renovated OCES has an ENERGY STAR rating of 99